CLAIMS

1. A semiconductor device comprising a MIS-type field-effect-transistor (FET), said MIS-type FET including:

a silicon substrate;

an insulating film formed on said silicon substrate and containing silicon and at least one of nitrogen and oxygen;

a metal oxide film formed on said insulating film and containing silicon and hafnium; and

a gate electrode formed on said metal oxide film, wherein:

a silicon molar ratio (Si/(Si+Hf)) in said meal oxide film is not lower than 2% and not higher than 15%.

2. The semiconductor device according to claim 1, wherein said metal oxide film includes therein polycrystalline particles having diameters of not smaller than 30nm and smaller than 100nm.

3. The semiconductor device according to claim 1 or 2, wherein said MIS-type FET has a silicon nitride film on said metal oxide film.

4. A method for forming a metal oxide film containing silicon and hafnium by vapor phase deposition using metal-

organic hafnium and metal-organic silicon as metal sources and water as an oxidizing agent, wherein a partial pressure of said water is not lower than 1E-6Torr (1.33×10^{-4}Pa) and not higher than 1E-5Torr (1.33×10^{-3}Pa).

5. The method for forming a metal oxide film according to claim 4, wherein said metal-organic silicon is trisdimethylaminosilane.

6. The method for forming a metal oxide film according to claim 4, wherein said metal-organic hafnium is tetrakisdiethylaminohafnium.

7. The method for forming a metal oxide film according to claim 6, wherein said metal-organic silicon is trisdimetylaminosilane.

8. The method for forming a metal oxide film according to any one of claims 4 to 7, wherein a substrate temperature during deposition of said metal oxide film is not lower than 150 degrees C and not higher than 450 degrees C.

9. The method for forming a metal oxide film according to claim 8, wherein said deposition of said metal oxide film is interrupted by annealing in an oxidizing atmosphere at a

temperature not lower than 500 degrees C, and thereafter conducted until a specific thickness is obtained.

10. The method for forming a metal oxide film according to any one of claims 4 to 7, wherein deposition of said metal oxide film is interrupted by annealing in an oxidizing atmosphere at a temperature not lower than 500 degrees C, and thereafter conducted until a specific thickness is obtained.

11. The method for forming a metal oxide film according to claim 10, wherein said deposition of said metal oxide film is interrupted at a film thickness not larger than 1mm by said annealing using a temperature not higher than 500 degrees C, and thereafter conducted until said specific thickness is obtained.

12. The method for forming a metal oxide film according to claim 11, wherein annealing in an oxidizing atmosphere is conducted at a temperature not lower than 500 degrees C, after said deposition of said metal oxide film.

13. The method for forming a metal oxide film according to any one of claims, wherein annealing in an oxidizing atmosphere is conducted at a temperature not lower than 500 degrees C, after deposition of said metal oxide film.

14. The method for forming a metal oxide film according to claim 12, wherein annealing in an inactive gas atmosphere is conducted at a temperature not lower than 700 degrees C, after said deposition of said metal oxide film.

15. The method for forming a metal oxide film according to any one of claims 4 to 7, wherein annealing in an inactive gas atmosphere is conducted at a temperature not lower than 700 degrees C, after deposition of said metal oxide film.

16. A method for manufacturing the semiconductor device according to any one of claims 1 to 3 by using the method for forming a metal oxide film according to any one of claims 4 to 7 to form said metal oxide film.

17. The method for manufacturing the semiconductor device according to any one of claims 1 to 3 by using the method for forming a metal oxide film according to claim 9 to form said metal oxide film.

18. The method for manufacturing the semiconductor device according to any one of claims 1 to 3 by using the method for forming a metal oxide film according to claim 11 to form said metal oxide film.

19. The method for manufacturing the semiconductor device according to any one of claims 1 to 3 by using the method for forming a metal oxide film according to claim 12 to form said metal oxide film.

20. The method for manufacturing the semiconductor device according to any one of claims 1 to 3 by using the method for forming a metal oxide film according to claim 14 to form said metal oxide film.